Third sunniest January on record starts the year for the UK

Description

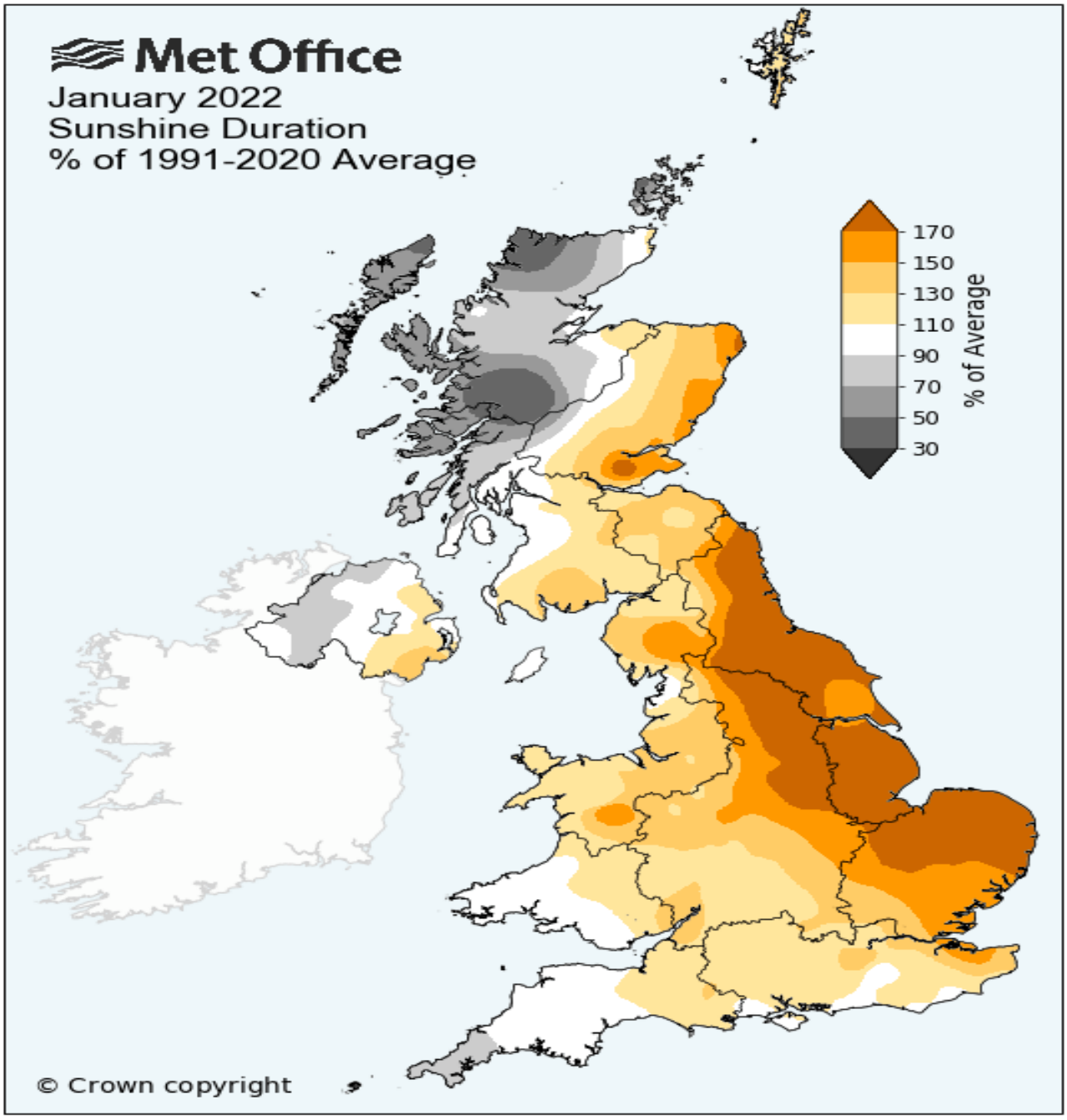
January 2022 was the sunniest start to a year on record for England, and the third sunniest for the UK in provisional figures released by the Met Office.

England saw an average 80.7 hours of sunshine in January, putting it at the top of a series that dates back to 1919. The UK saw an average of 62.7 hours of sunshine in the month, which makes it the sunniest January since 2001 and the third sunniest overall.

Wales, Scotland and Northern Ireland also had above average sunshine hours in the month, although not enough to trouble any records. Wales had an average of 55.1 hours of sunshine (17% above average), Scotland 38.1 hours (8% above average) and Northern Ireland 43.4 hours (2% above average). Northern Scotland was the notable exception with a relatively dull month and just 76% of average sunshine.

Sunshine amounts were especially high in northern and eastern England, with a number of regions seeing record-high levels of sunshine in the month, including North Yorkshire (88.6 hours), Derbyshire (80.3 hours) and Nottinghamshire (105.4 hours). For Nottinghamshire, the final figure for sunshine hours was a massive 79% more than their long-term average for the month, and Norfolk exceeded its average sunshine total by 92%.

East Anglia and the Midlands also saw record levels of sunshine in the month, with East Anglia’s figure of 101.8 hours of sunshine topping the previous record of 85.5 hours set in 2001. For the Midlands, 78.4 sunshine hours topped the 74.3 hours seen in 1952.



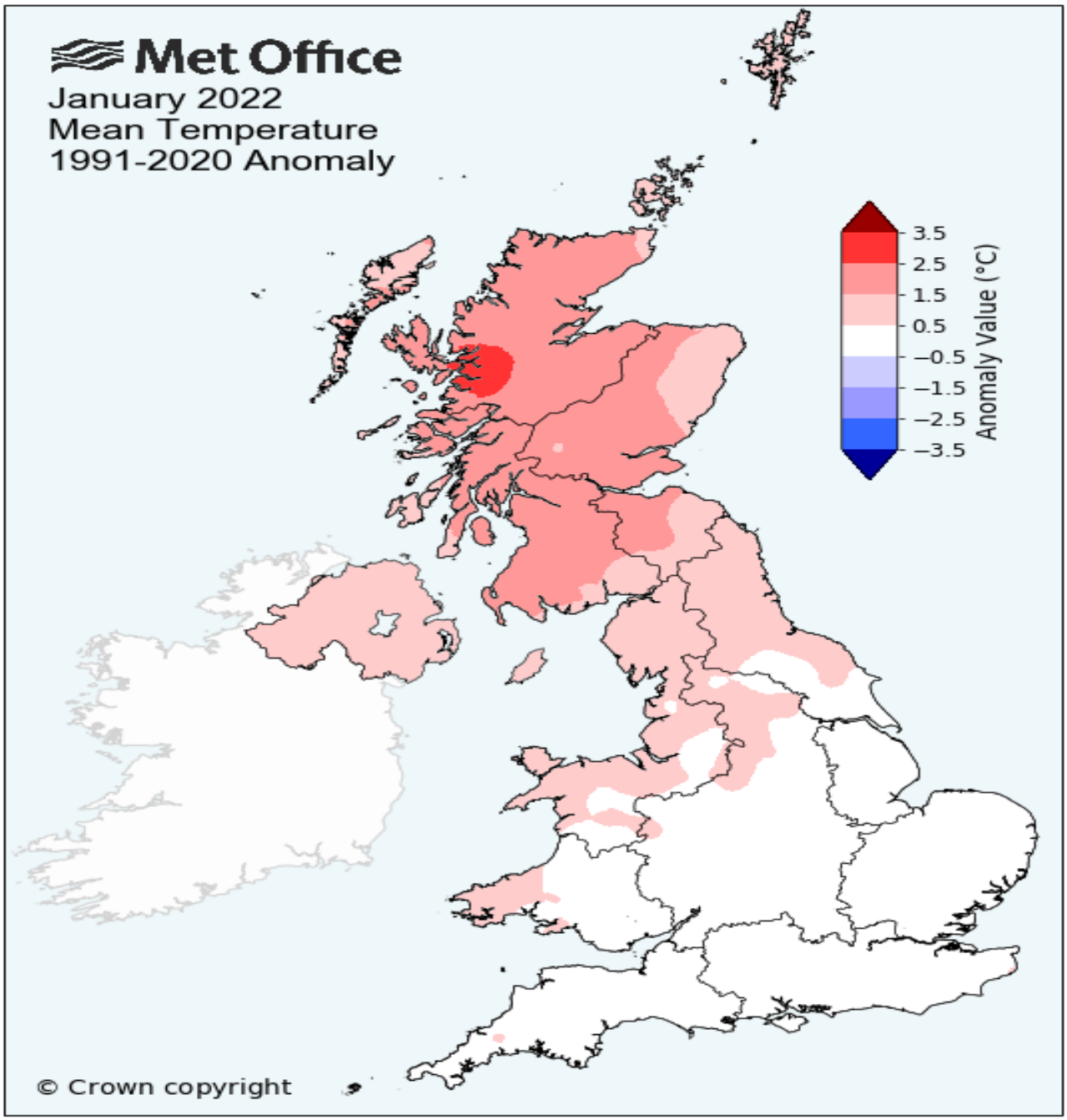
Sunshine hours in January 2022 against the long term average

A mild theme

January started with the warmest New Year's Day on record for the UK, with 16.3°C recorded at St James's Park in London. Scotland and Wales also broke their New Year's Day record high temperatures, as 15.9°C was reported at Achnagart (Scotland) and 15.6°C at Hawarden (Wales).

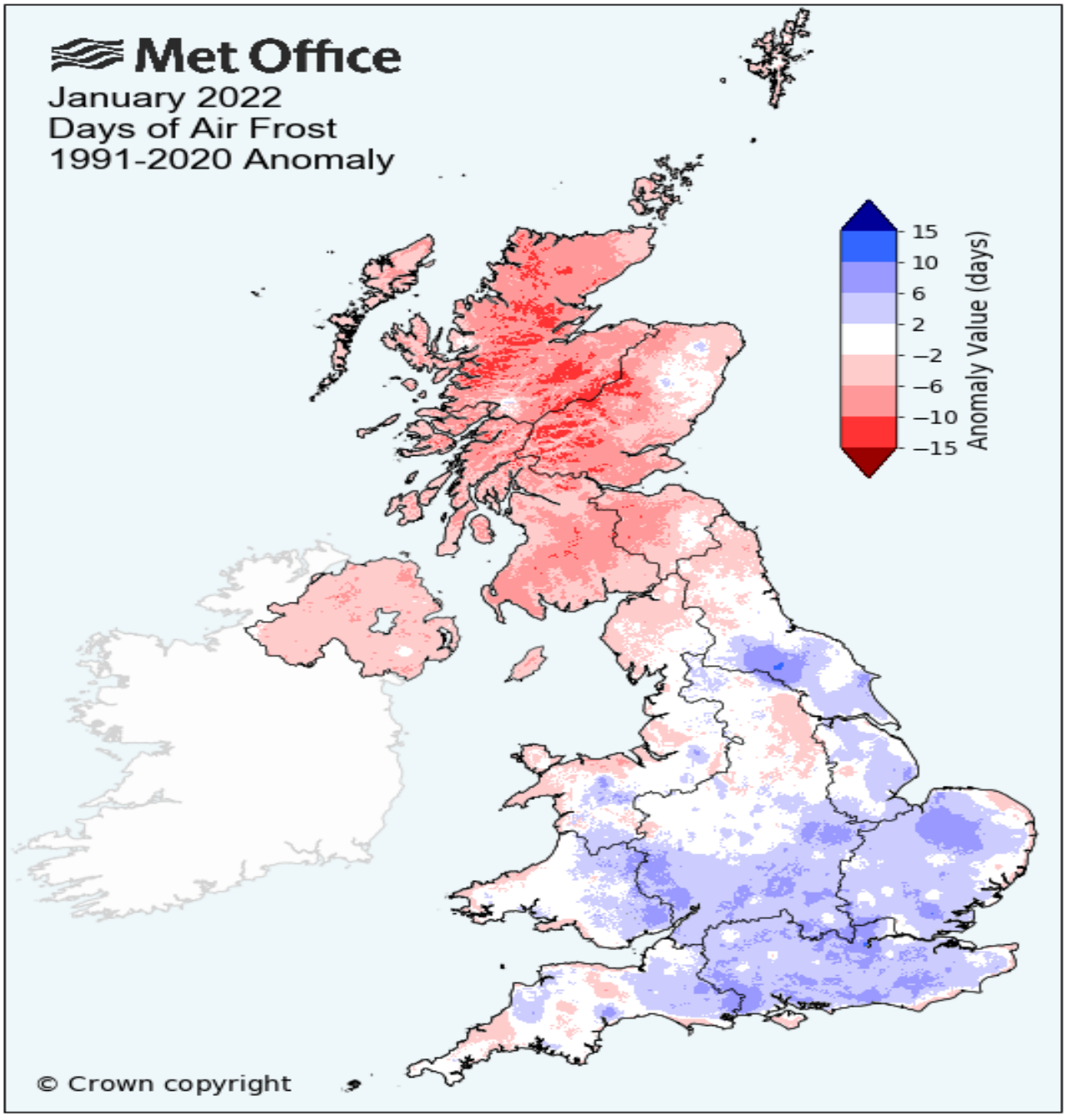
The mild theme continued for much of the month, albeit with some cool nighttime temperatures in the south for much of the month.

It was an especially mild January for Scotland, with a mean temperature of 4.7°C putting it as the country's sixth warmest January on record and 1.8°C above the long-term average.



Mean temperature for January 2022 versus the long term average

Mild conditions were not quite as dominant further south, low levels of cloud resulted in some spells of low overnight minimum temperatures being reported along with more ground frost and air frost compared to further north. For only the third time in 30 years, England saw more air frosts in January than Scotland, with an average of 12 days of air frost topping the 8 days seen in Scotland. Wales reported an average of 11 days and Northern Ireland 5 days.

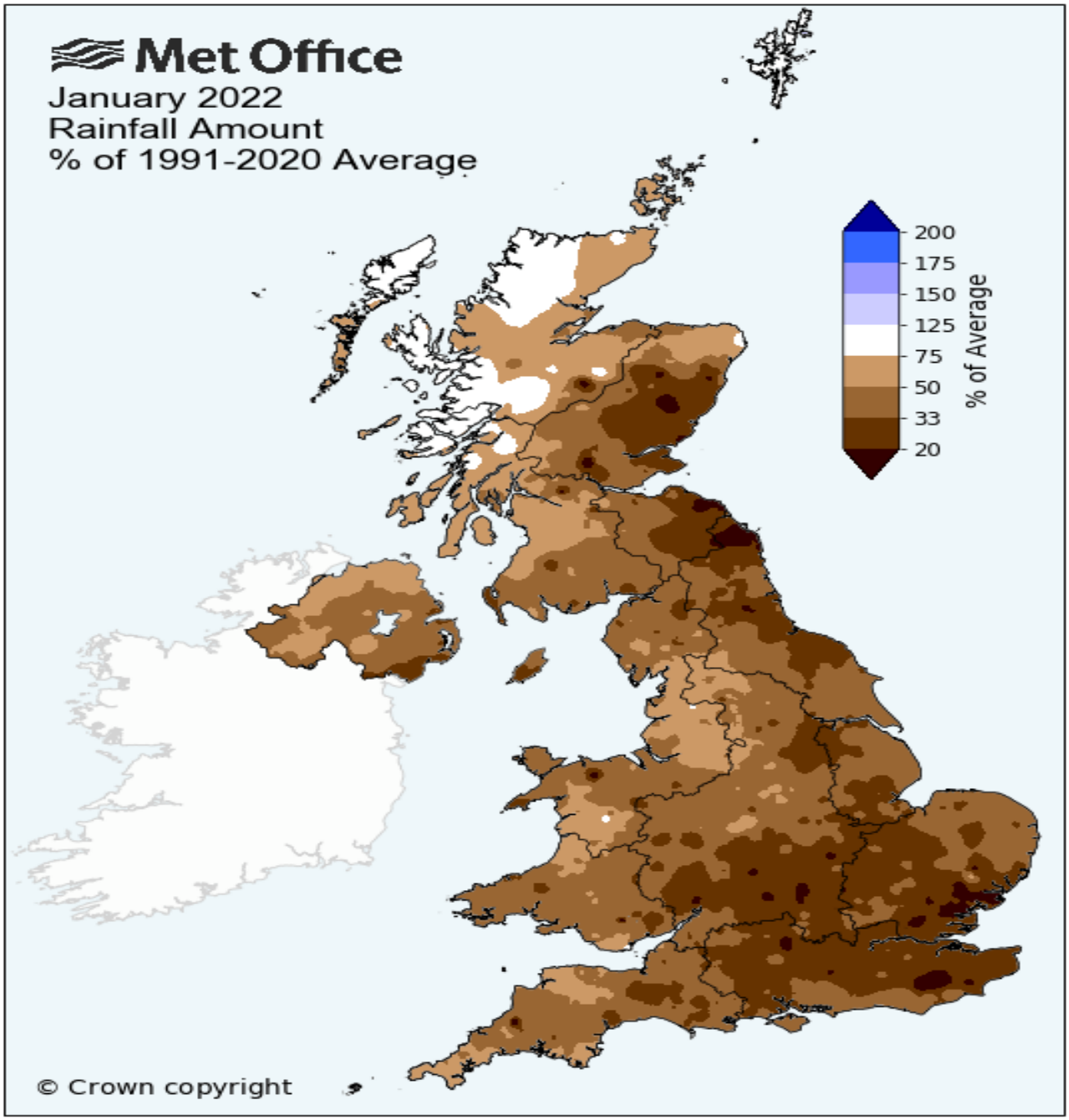


Air frosts for January 2022 against the long term average

Dry for most

Despite a late-month flurry of rain in the north, January has seen less than half the average rainfall for the month for the UK. An average of 61.3mm of rain fell, which is well below the average of 121.5mm. Scotland was the only country to report more than 50% of its average rainfall, but its figure of 110.2mm was still only 62% of its average.

England had its ninth driest January in a series that goes back to 1862, with just 38% (31.7mm) of its average rainfall. Wales had 44% (68.9mm) of its average, and Northern Ireland 47% (53.4mm).



Rainfall amount for January 2022 versus the long term average

Dr Mark McCarthy of the National Climate Information Centre said, “January has been a dry and sunny

month. It has been notably mild for Scotland but a fair share of frosty mornings across much of England.

“High pressure has had a big influence over the UK’s weather this month, with a persistent area of high pressure in the south dominating the picture from mid-month and resulting in a relatively dry month. The exception to this for the UK was the late influence of Storms Malik and Corrie in the last weekend of January, bringing rain and disruptive winds to many in the north.”

Indeed, this is reflected in mean wind speeds which have been generally above average in the north of Scotland in January, but relatively calm across much of England and Wales.

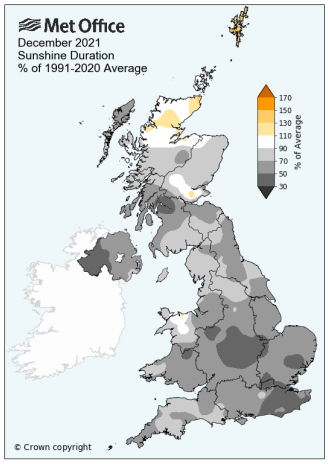
Provisional January 2022	Mean temp (°C)		Sunshine (hours)		Rainfall (mm)	
	Actual	Diff from avg (°C)	Actual	% of avg	Actual	% of avg
UK	4.7	0.8	62.7	132	61.3	50
England	4.6	0.2	80.7	146	31.7	38
Wales	4.9	0.5	55.1	117	68.9	44
Scotland	4.7	1.8	38.1	108	110.2	62
N Ireland	5.5	1	43.4	102	53.4	47

Winter so far

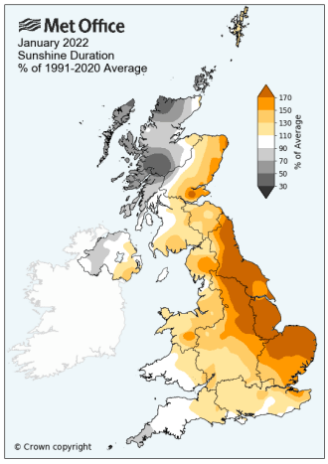
Statistics for this section are referring to the period from 1 December 2021 to 1 February 2022, with a month of meteorological winter still to come.

Two months into meteorological winter and the season so far has been mild, with mean temperatures for the UK sat at 5°C, which is 0.9°C above the long-term average for the whole of winter.

Despite January’s noteworthy sunshine, December’s contrasting dullness – the dullest since 1956 and the sixth dullest calendar month in records back to 1919 – means that winter so far has still been slightly duller than average, with 87.7 hours of sunshine so far, which is 54% of the average for the whole of the season. By 1 February you’d normally expect to have seen 68% of the average sunshine.



December 2021 sunshine map against the long term average



January 2022 sunshine map against the long term average

With a month of winter still to go, it has been a mild season so far, with a month still to go before the full figures for winter are released.

Date Created
February 2022

Scientists ‘move’ New Zealand into historical cyclones to model impact

Description

Met Office scientist Dr Ian Boutle has been working with NIWA in New Zealand on modelling weather events for the country’s contingency planners. The below blog highlights how they took on the challenge in an unusual way.

Tropical cyclones don’t tend to directly impact on New Zealand. So, when scientists from the Met Office and NIWA (New Zealand’s National Institute of Water and Atmospheric Research) were asked to model potential impacts from cyclones on the country, it was a problem that needed some creative thinking. Their unique answer? Simply ‘move’ the land into the path of historical storms – metaphorically speaking.

By the time tropical cyclones reach New Zealand’s latitudes, they have already undergone a transition into extra-tropical cyclones. These tend to be a bit weaker than the tropical cyclone they derived from, but they can still pack a heavy punch and there is a history of ex-tropical cyclones impacting on the country, hence the need for this project to see potential impacts from a stronger storm getting to the country.

The research is part of New Zealand’s mitigation and adaptation planning for the future and the data provided by the simulations is now being worked on by New Zealand contingency planners to see how infrastructure in Auckland, New Zealand’s most populous city but one that has historically escaped the worst impacts of previous ex-tropical cyclones, would cope with these impactful weather events. Modelling weather events in this way provides contingency planners with reliable data, even when there’s little history of such impactful weather hitting the region.

Met Office Scientific Manager Dr Ian Boutle, who worked with NIWA as part of a secondment, said, “Historically, New Zealand doesn’t get affected by fully-fledged tropical cyclones but a changing climate means that it’s something that’s possible in the future, as warmer sea surface temperatures wouldn’t weaken these cyclones as much as they travel south.”

Climate change is just one reason behind the research. City planners, flood experts and scientists are currently working through the data provided by NIWA to see how the country would cope in the face of direct impact from an ex-tropical cyclone, including investigating the potential for landslides, flooding and building damage.

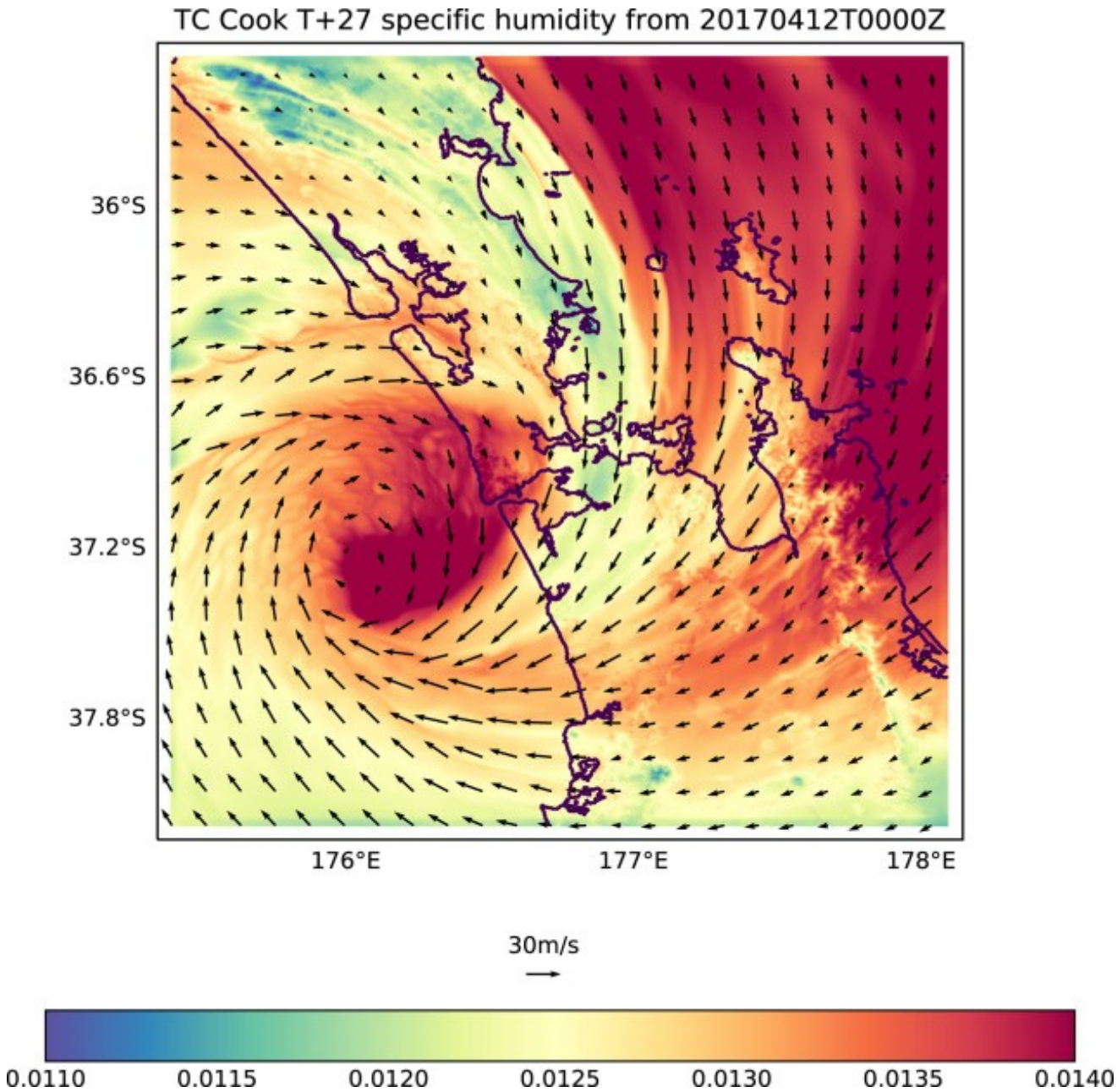
Shifting into real weather

The requirement for modelling these different realistic scenarios created an opportunity for the scientists to consider how to model the most realistic weather events for the country. The answer, of course, was to use real weather events.

“Historically for New Zealand, there’s not much to go on in terms of active cyclones making landfall,” explained Dr Boutle.

“One idea is to create an atmospheric state inside the Met Office’s Unified Model to create a cyclone that follows the path you want and go from there. However, that’s very tricky to do within the model and raises questions as to what would be a realistic cyclone coming at New Zealand from the tropics.

“What turned out to be much easier and more effective to do was to look at recent ex-tropical cyclones that have passed close to New Zealand, and simply pick up and shift the landmass into its path and let the simulations show how the cyclone would behave and develop if it did hit land.”



This map, as captured from the research, shows the north of New Zealand being affectedby Tropical Cyclone Cook

In order to lessen the impacts of sea temperatures being warmer further north, scientists only shifted New Zealand on the east-west axis. With New Zealand in its ‘new’ location, the Met Office Unified Model ran the simulations for the weather set up, but this time taking in to account the impact of the new landmass and developed the weather system differently.

This meant NIWA could provide the New Zealand government with realistic scenarios, as it was a real weather event in the vicinity of the country. Model runs were done for five different cyclones, shifting New Zealand into the path of each one to provide a number of scenarios for the planners to analyse.

“When we move the landmass in to the path of a cyclone we already know has happened, what it does is develop the system in a different way once it hits land instead of sea. In short, cyclones evolve

differently over land and the model reflects that and provides realistic data for us on wind speed, rainfall amounts and trajectory," said Dr Boutle.

"What we found is that by introducing land to these historical events, wind speeds obviously drop when land is reached, but New Zealand's northern city of Auckland is right on the coast and so impacts from wind were more severe here. In terms of rainfall amounts, this could change either way when we introduced the new landmass, with some model runs giving higher levels of rain and some producing less than if it didn't hit land."

Proof of concept and climate change

The research, published with NIWA colleagues Stuart Moore and Richard Turner, plays an important role for New Zealand's planning going forward, but it also acts as a proof of concept for other scientists researching in similar areas.

Dr Boutle concluded: "With the rise in global temperatures we've seen since the industrial revolution, it's possible for cyclones to move differently in the future, using a warmer sea surface temperature to retain strength and this increases up the possibility of new routes. Modelling in the way we have opens new possible research into potential impacts of these long-term climate changes."

Date Created
February 2022

Is it going to snow?

Description

Updated 4th February 2022

There's a lot of speculation in the media about snow blanketing the country in the coming days. But what is actually going to happen, and will you see snow where you live?

Met Office Chief Meteorologist, Andy Page said: "We have some fairly typical winter weather in store. It will often be windy, with bands of rain moving south-east followed by colder weather with wintry showers, these particularly affecting Scotland. It is not unusual for us to see snow in February, and there are no signals currently for anything out of the ordinary."

The cold interlude has been brought in by an active cold front. which has now cleared south-east England. Behind this front colder air is spreading across the UK bringing a sharp fall in temperatures.

There has been snow across parts of Scotland, northern England and Wales and National Severe Weather warnings are in place for parts of Scotland for today (04/02/22) and the weekend. There was also some sleet and snow across central and southern England, particularly over the Chilterns, near the cold front.

As we go into the weekend we move from a cold north westerly airstream to a milder westerly air, at least for a time, although, the weather will stay windy for much of the UK and wet across western hills. Colder air with snow showers will return to Scotland again by Saturday night.

As we look ahead at the rest of February indications are that this pattern of milder spells with short colder interludes will continue. Northern areas are likely to see more rain and strong winds, interspersed with wintry showers and overnight frosts. While further south, it looks like milder, drier, but still often fairly cloudy conditions will dominate.

Why do we see these temperature variations during the winter months? They are the result of the jet stream oscillating around the UK. When the jet stream lies to the north of us, as it has been for the last few days, we see milder conditions. But if it dips further south, as it is over the next couple of days, it allows colder air from the north to cross the country and temperatures fall.

Date Created
February 2022

Refreshed weather graphics for Met Office

Description

Eagle-eyed viewers might have spotted that we've made a few changes to our weather forecast graphics, so we wanted to share what and why some things have changed as we've continued to evolve our forecasts.

Evolution, not revolution

It's been six years since the Met Office presented weather forecasts have undergone a redesign, but it was important that the new designs didn't detract from any of the clarity we've been providing weather forecasts with. Indeed, over 150 years have gone in to making our forecasts communicate the weather clearly, so the latest design is very much an evolution of a theme rather than a revolution.

Small-scale redesigns have taken place on the display for clocks, headlines, tables, temperatures and maps. However, what has been a key consideration for the redesign, which took input from a team of designers, meteorologists and presenters, has been a shift in some layout options to allow for better use of forecasts on social media.

Clocks and lower-third graphics have shifted away from where the 'play' bar often is online, annotations and temperature icons have been designed to display clearer on mobile phones, keeping the Met Office forecast as useful as possible, no matter where, or how, people choose to watch.

Met Office Meteorologist and Presenter Aidan McGivern said, "We didn't just make changes for the sake of it. A lot of consideration was put into how people use our forecasts, online, on the app and on social media so that we can communicate the weather more clearly, and with greater consistency."

Accessibility

The weather affects us all, that's why forecasts need to be accessible to as many people as possible. We've made some changes to the colour scales we use to make forecasts easier to view for more people and will continue this work in the coming months.

Another change, spurred on by feedback, has been to change how the UK itself is displayed. By viewing the UK from directly above, instead of at an angle, those in northern areas now have a clearer view of the weather.

Going forward

As usual, the forecasts will evolve in the coming weeks and months, reacting to continued feedback to make sure they're as useful as possible. Upcoming changes in the pipeline include improving colour scales more to improve accessibility, improved weather graphics software and displaying more of the UK's towns and cities in forecasts.

Aidan continued, "We're looking forward to showing off further improvements to our forecast this year. Keep the feedback coming, we'll keep listening and we'll keep evolving."

Date Created
February 2022

127 years since UK’s joint-lowest temperature… will we see it again?

Description

11 February will mark 127 years since the UK’s joint-lowest temperature was recorded, at Braemar in Scotland. The record low figure of -27.2°C has been equalled twice, but never exceeded, in all instrumental records since the mid-19th century. It remains one of the longest-standing national records in the Met Office archives.

In the 127 years since 11 February 1895, the record low figure of -27.2°C has been reached a further two times, once in Braemar on 10 January 1982 and again on 30 December 1995 at Altnaharra.

The 1895 record is the second-oldest individual national temperature record still standing and, in the context of warming global climate, raises an interesting question on the likelihood of seeing temperatures so low again in the UK.

Of course, UK weather is notoriously erratic, capable of balmy days in the summer heat and bone-chilling cold snaps in the winter. However, when looking at the UK individual national records for temperature extremes, three countries (England, Scotland and Northern Ireland) have broken their highest maximum temperature record since the year 2000. However, for lowest minimum temperatures, only Northern Ireland has broken a national record since 2000, when it got to -18.7°C in 2010.

In the context of a changing climate, daily temperature records in any year are just one part of the picture. An overall warming global climate is evident, indeed, the warmest seven years globally have all been since 2015, but what does this long-term warming trend mean for breaking individual, daily low temperature records?

11 February, 1895

The weather chart for 11 February 1895, as taken from the Met Office archives

The weather set-up for the UK's joint-lowest temperature on record is certainly not an unfamiliar one, albeit more extreme than most.

A very cold easterly flow controlled the weather over the UK and most of Europe for much of the month, with some heavy snow showers reported in northern areas early on in February. The easterly wind and a shallow low-pressure system centred over the north of the UK saw temperatures plunge for a prolonged period. It's a fairly familiar weather pattern for the UK, and is frequently referred to as a 'Beast from the East', although this one had less widespread snow than the 2018 snow and low temperatures .

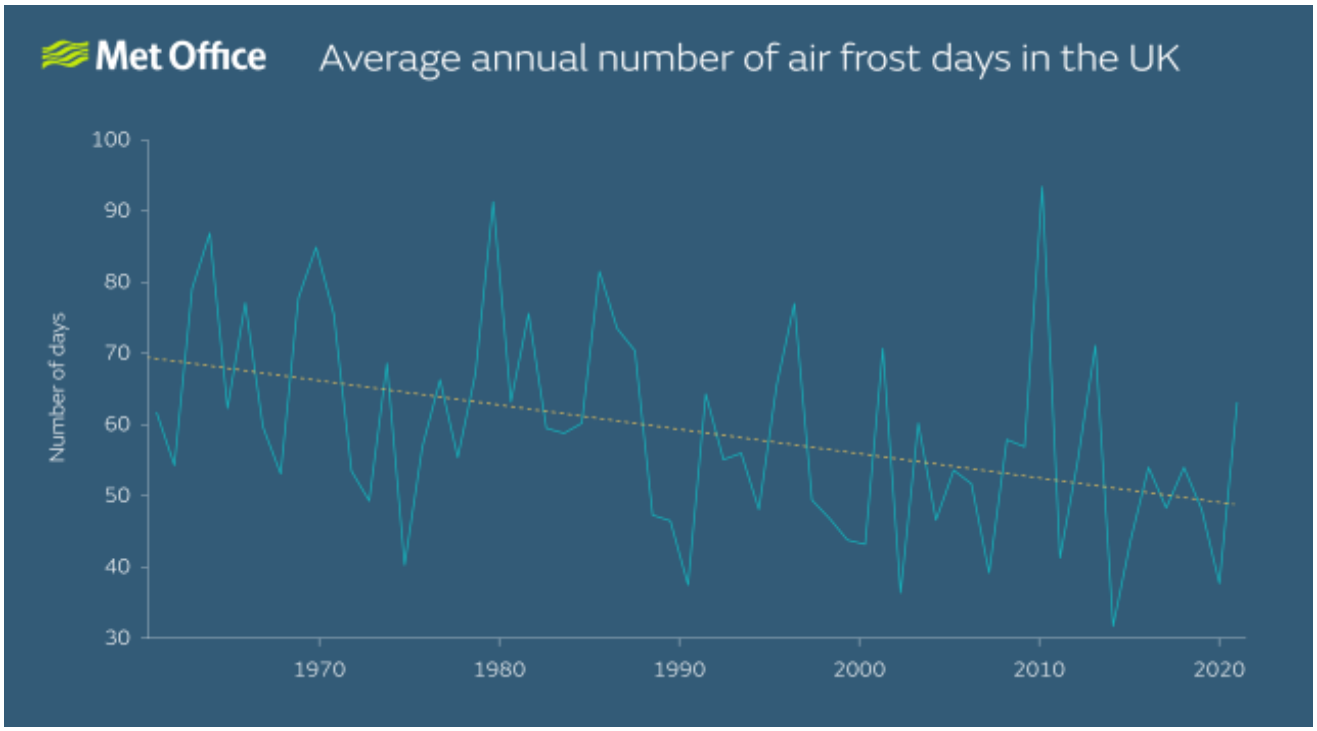
However, beyond the initial snow in the north, February 1895 was a dry and clear month, which locked in very low temperatures overnight with some harsh frosts.

Digging into the Met Office archives, Symons's Monthly Meteorological Magazine published a letter at the time that stated, "The great frost seems to have broken up, but it will long be remembered. From December 30th to February 27th (60 days) the thermometer fell below 32°F [0°C] every night except four."

A frosty picture

One indicator of cold conditions is frost, so a way of looking at trends in spells of cold and wintry weather is to delve into the statistics to look at average number of frost days for the UK in a year.

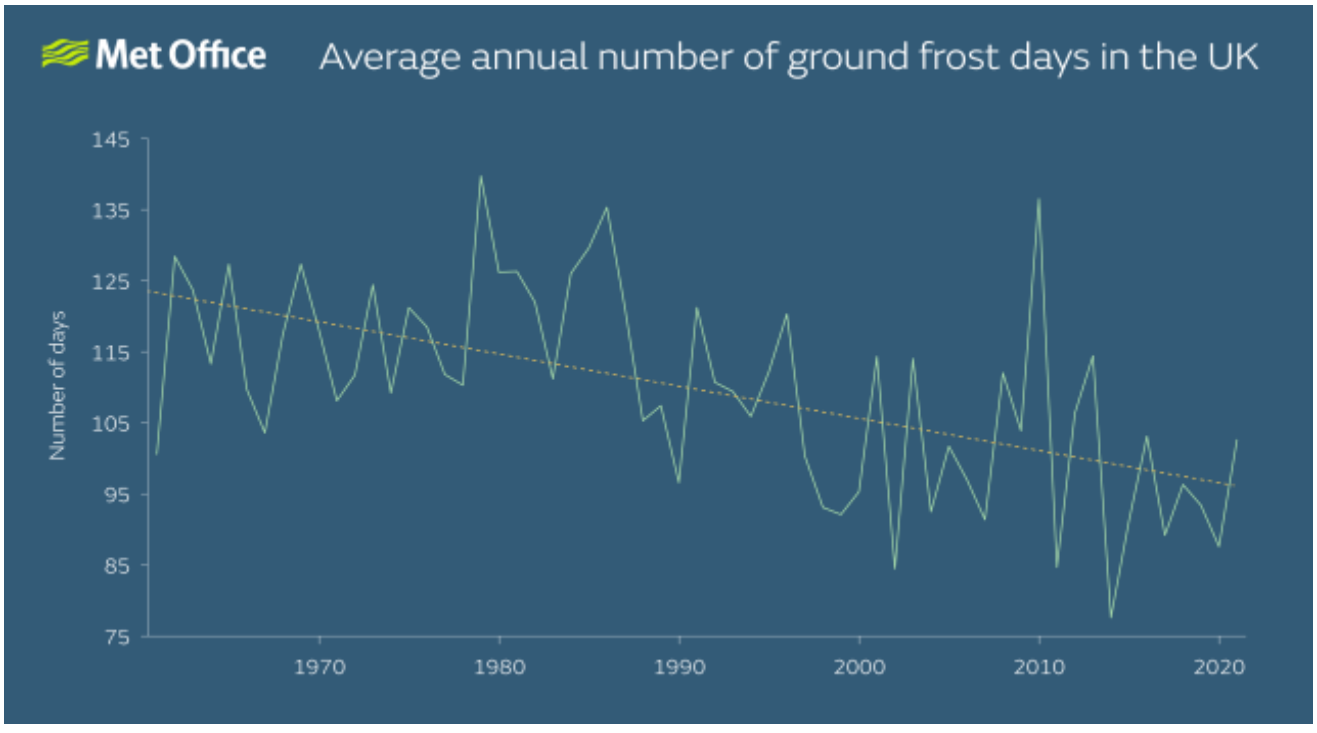
Air frost, which is when the air temperature falls below 0°C as measured one metre above the ground, has been occurring less regularly in a UK series which begins in 1960. Looking at 30-year meteorological averaging periods, the 1961-1990 average number of air frosts in a year in the UK was 64 days. The current averaging period, which is from 1991-2020, shows an average of 53 days of air frosts.



Graph showing the average number of air frosts days in the UK per year, with an added dotted trend line

It's a very similar picture for the prevalence of ground frost, which refers to the formation of ice on the ground, objects or trees.

The 1961-1990 average number of ground frosts in the UK was 118. Fast-forward to the latest averaging period of 1991-2020, and it's down to 102.



Graph showing the average number of ground frost days in the UK per year, with an added dotted trend line

However, it is still possible for temperatures as low, or indeed lower than -27.2°C to occur at some point. What it does show is that below-freezing conditions in general are becoming less frequent in the UK on a globally warming planet.

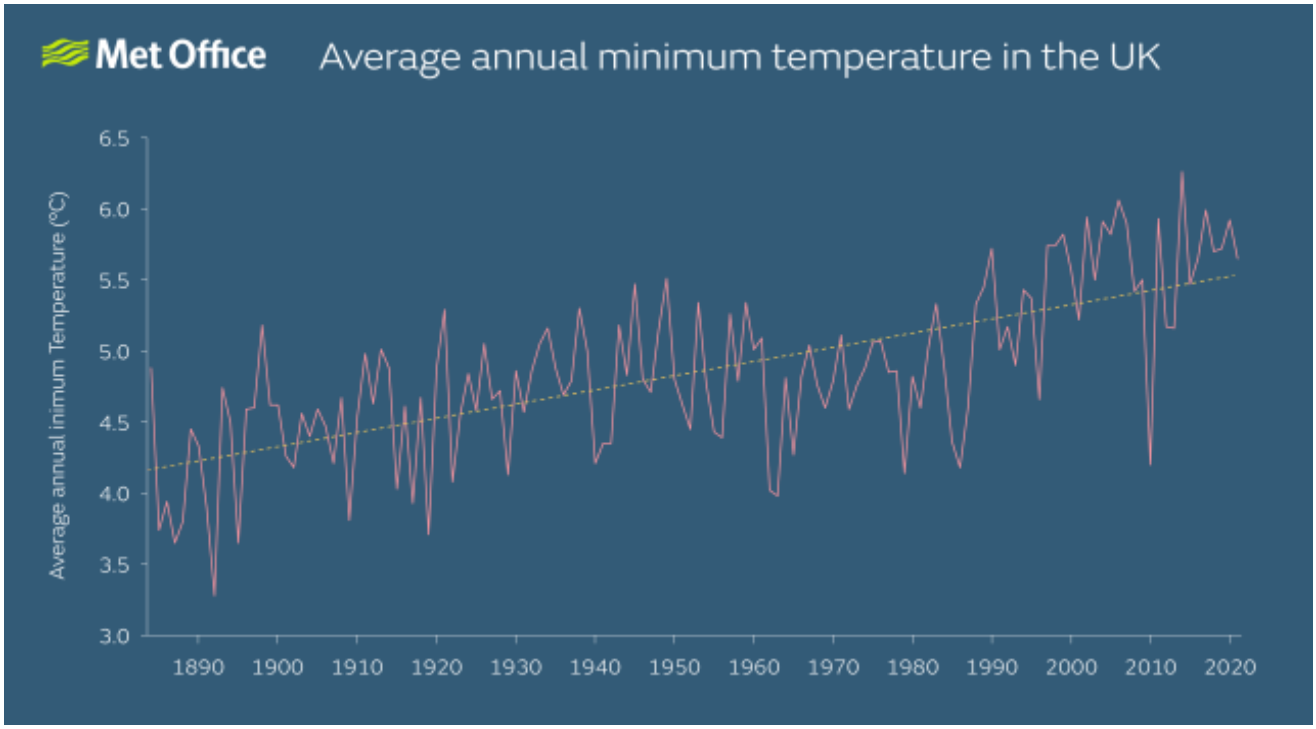
Dr Mark McCarthy of the National Climate Information Centre said, “Record-breaking temperature extremes are, by their very nature, sporadic. Declining frosts are a symptom of a warming global trend, and that same warming trend is responsible for making extreme cold less likely in the UK.

“The variability of the weather in the UK is demonstrated in the lowest minimum temperature record. Despite a long-term warming trend, the record low figure of –27.2°C has been hit a further two times, showing that extremes of cold are still possible on a warming planet, even if it’s becoming slightly less likely.

“What the long-term frost data shows us is another indicator of how a warming planet influences conditions and shifts averages. For frosts, it shows us less frequent frosts, which, in effect, shows there are fewer opportunities for record breaking low temperatures.”

Average minimum temperature

Annual average minimum temperatures have also been increasing in a series which dates back to 1884. The 1961-1990 average annual minimum temperature was 4.8°C, while for 1991-2020 the figure is 5.5°C.



Graph showing average minimum temperatures in the UK per year, with an added dotted trend line

“The warming trend globally has shifted average UK temperatures up, and that’s no different when it comes to minimum temperatures,” explained Mark.

“Like all averages, this doesn’t mean extreme minimum temperatures are impossible, but it does change the context of the climate and reduces the chances of extreme low temperatures.”

Find out more about climate change’s influence on UK meteorological averages and the change to the latest averaging period.

You can access an archive of meteorological magazines on the Met Office Digital Library and Archive.

View the current records and UK climate extremes on the Met Office website.

Date Created
February 2022

Using Met Office climate science to map future risks

Description

Every five years the UK government is required to publish a Climate Change Risk Assessment (CCRA). The purpose of the assessment is to set out the risks and opportunities facing the UK from climate change. The 3rd CCRA was presented to Parliament on Monday 17th January 2022 and will help inform both mitigation and adaptation strategies.

A major component the CCRA relies upon is the Technical Report, which provides an independent scientific foundation for the risk assessment to be built on. Bringing this important section together for use in the latest assessment was a mammoth task with over 450 experts working for more than three years, led by the University of Exeter in partnership with the Met Office.

The Technical Report for the latest CCRA was published in June 2021, you can read more about the report and how it was developed in our blog.

The report examined the consequences of global warming of 2°C and 4°C above pre-industrial levels and the extent to which we are prepared for these. The 2°C case is typically reached through emission reduction scenarios that are similar (but not quite as strict) to those needed to limit median warming to well below 2°C or 1.5°C, as required by the Paris agreement.

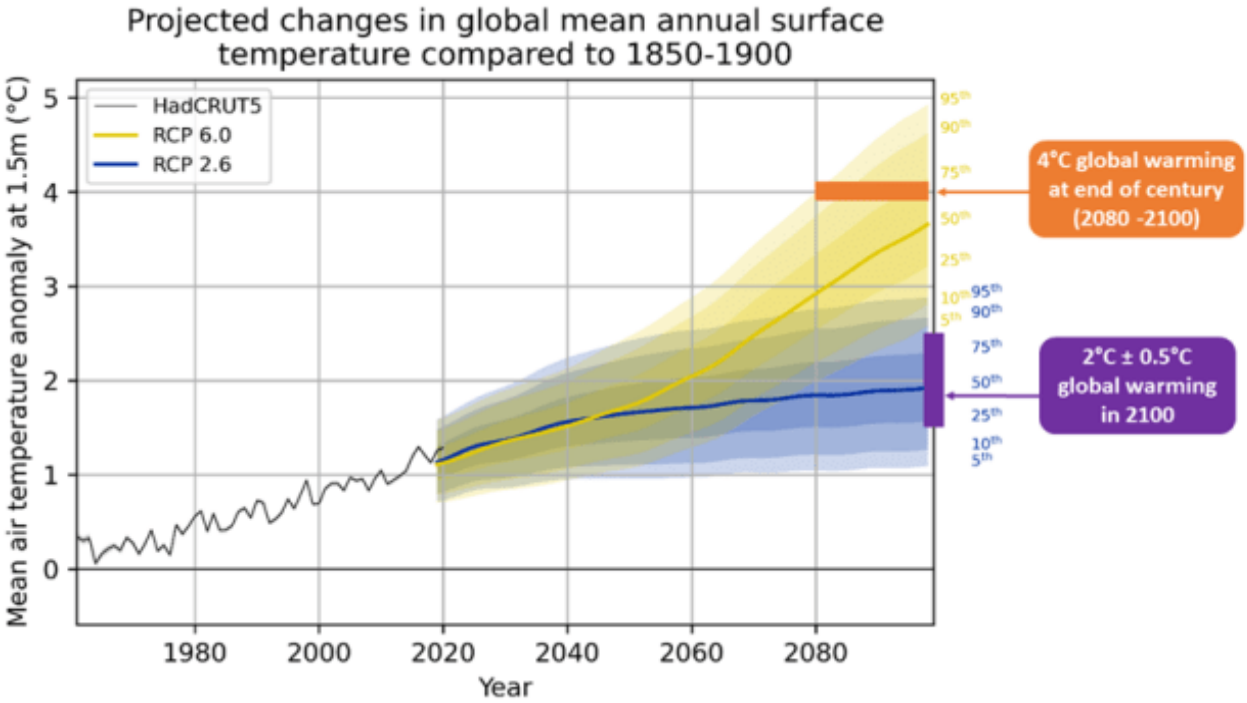
The 4°C warming level can be reached via a range of emissions scenarios, including those with emissions within the range corresponding to current policies and those where emissions back-track on existing policies and agreements. For the former, stronger climate feedbacks are required to reach 4°C. For the latter, the warming level can be reached with more modest climate feedbacks. The Met Office's UKCP18 projections, funded by BEIS and Defra, were a key source of information for the risk assessment, providing information for both 2°C and 4°C of warming.

Director of the Technical Report, Professor Richard Betts MBE, said: "By establishing that under current emissions commitments 4°C of global warming is still a possibility, our results suggest that we cannot be complacent about the potential to reach this severe level of warming. Although the chances of reaching 4°C of global warming this century are becoming smaller, especially with the additional pledges made at COP26 in November, it is still a scenario we could see even with current levels of ambition on emissions cuts.

"Because the impacts of climate change become more amplified the hotter the global average temperature gets, it's important to examine even these less likely eventualities so we can understand the risks we are taking by not reducing emissions rapidly, and see what ultimately may need to be done through adaptation to try to limit the damage if we fail to do this."

With rising global temperatures, we are edging closer to the thresholds for more and more so-called 'High Impact, Low Likelihood' (HILL) events. HILL events go beyond traditional weather extremes, potentially taking the climate system into uncharted territories, providing a challenge for risk assessments such as CCRA3. You can read more about HILL events and why scientists are calling for

more research into the challenge they provide in our recent blog article.


Projected changes in global mean annual surface temperature compared to 1850-1900
Mean air temperature anomaly at 1.5m (°C)
HadCRUT5
RCP 6.0
RCP 2.6
4°C global warming at end of century (2080 -2100)
2°C ± 0.5°C global warming in 2100
Year

The graph above shows how global temperature rises of 4°C by 2100 are still possible under current emissions commitments, although the likelihood is decreasing, especially after the additional pledges made at COP26. Analysis in CCRA3 found that the emissions scenario known as "RCP6.0" was within the range of outcomes consistent with current policies as of mid-2021. CCRA3 also considered a scenario of limiting global warming to around 2°C, illustrated here with the RCP2.6. The yellow and blue plumes show the likelihood of different global temperature change pathways with these 2 scenarios in the UKCP18 climate projections.

The UKCP18 projections were also used to investigate a number of specific risks linked to increased flooding, drought, wildfire and sea level rise arising from global warming reaching 2°C and 4°C by 2100. Additionally, the projections informed an assessment of interacting and cascading risks. The Technical Report team also drew on a large number of previous studies of other risks using other climate projections, and mapped these to the framework of 2°C and 4°C warming by 2100.

Professor Betts added: "The UK Climate Projections provided crucial, state-of-the-art information to underpin the risk assessment in CCRA3. The close interaction between climate scientists, impacts researchers and stakeholders also helped us see how additional analysis and new projections can help inform future assessments."

The content of the Technical Report was discussed at an event during COP26 in Glasgow. You can watch the event, at which Professor Betts was on the panel, on the UK Government YouTube channel.

Work to underpin the technical report for the next CCRA is already underway.

Date Created
February 2022

Adaptation: why do we need it?

Description

In recent months we've seen the launch of the Intergovernmental Panel on Climate Change (IPCC) report on the latest physical climate science (Working Group 1) and the UK-hosted COP26 conference in Glasgow. In the UK, the Government has also published their latest Climate Change Risk Assessment, CCRA3. Over the coming months we'll see the release of new IPCC reports on impacts, adaptation and vulnerability (Working Group 2) and on mitigation of climate change (Working Group 3). It is therefore timely to consider why we need adaptation[1] and how this relates to mitigation, or reducing emissions, to help reach and go beyond a net zero goal.

Climate change impacts

Mitigation and adaptation are the key tools available to us in order to avoid the worst climate impacts on people, infrastructure and nature. However, ideally we need to make changes in ways that enhance other development goals including reducing poverty and inequality, promoting good governance and improving wellbeing.

We have observed climate change on every continent, with attribution studies finding a human fingerprint in many key aspects including temperature, rainfall, drought and sea-level rise. There is also increasing evidence of the impacts these changes in climate hazards have already caused, with some parts of the world much more vulnerable to the hazard than others.

Looking into the future, our climate model projections provide ranges of how future climate hazards might evolve in time, with the amount of climate change being strongly driven by the magnitude of future greenhouse gas emissions and the sensitivity of the climate system to the higher levels of atmospheric greenhouse gas concentrations. Whilst the challenges from climate change present themselves at a local level, they are present across the globe and the atmosphere doesn't take into account where emissions come from – all sources of greenhouse gas emissions contribute to warming and climate disruption.

Why not just reduce emissions?

Returning to the original aim – to avoid climate impacts in a way that is sensitive to the other stresses and pressures on people and nature – reducing, or mitigating, emissions seems like the ideal solution. Mitigation of emissions also has benefits beyond avoiding climate impacts, such as improved energy security and better air quality.

Mitigation measures can reduce reliance on fossil fuels and the associated carbon emissions

However, whilst mitigation can avoid some of the impacts, even in the most ambitious emission reduction scenarios we are committed to at least some further global warming beyond present day levels. Even if global emissions are reduced to net zero over the next few decades, uncertainty in the climate response means we may actually still experience considerable levels of global warming.

Local action

Adaptation options are almost always implemented locally, providing direct benefits to local populations, as well as indirect benefits to those connected to or dependant on a region. Many adaptation actions, particularly the introduction of physical protection measures, can often be implemented relatively quickly. For instance, the time to construct the massive Thames Barrier in London was less than a decade. Carefully designed adaptations can also deliver additional benefits beyond avoiding climate impacts, including more hospitable and liveable urban environments.

The Thames Barrier protects London from flooding caused by tidal surges

So why not just adapt? The answer to this is multi-dimensional. Adapting to lower levels of climate change is more manageable and affordable than for higher levels of change, so mitigation makes adaptation easier. Indeed, costs of adaptation can grow exponentially with higher levels of warming, so without significant mitigation, adaptation may not be affordable. Even if we put the cost issues aside, there are limits to adaptation in most practical situations. For instance, there is only so high you can or might want to build a sea wall. Furthermore, adaptation doesn't solve problems such as ocean acidification, which is associated with the increase in atmospheric carbon dioxide, nor is it an option for many species and ecosystems threatened by a rapidly changing climate.

For those who favour adaptation in place of mitigation, the IPCC Working Group 1 report reminded us that net zero emissions are needed to stabilise warming at any level. If we kept greenhouse emissions constant at today's levels, we would not halt climate change, leading to even greater environmental consequences and reducing the options for adaptation.

To deal with the challenges of climate change there is a case for both strong mitigation and adaptation, planned and delivered as part of a combined strategy. That strategy needs to take into account other development aims, and the differing capacity of different peoples, organisations and nations to respond. It also needs to be strongly evidence-based. These climate resilient pathways or scenarios provide our roadmap to the future.

A partnership approach

At the Met Office we work with partners to play an important role in the transition to a resilient net zero future. Weather advice provides early warning of events hours, days and even a few weeks ahead, and has become vital to protecting lives and keeping businesses running. Our seasonal outlooks provide information further out and are opening new opportunities for longer term tactical planning, for instance in the transport and energy sectors. Climate projection information, such as UKCP18 – the latest UK Climate Projections – is helping people understand the risks over coming decades and increasingly

enabling them to make plans for local adaptation.

In considering and developing our services to inform adaptation and mitigation we need to maintain a degree of humility and openness, recognising that valuable knowledge to inform solutions comes from the people facing the local challenges and who will have to live with the responses. We are increasingly learning how to co-develop adaptation and mitigation approaches, but have many lessons to learn, especially from recent projects in the developing world. Furthermore, even the best weather and climate information is only part of the solution, and we need to get better at combining this data with that from other disciplines to produce innovative ways forward for a resilient low carbon future.

We have been sharing information on adaptation on our social media channels this month. Follow #GetClimateReady to learn more and look out for a focus on mitigation soon.

[1] Adaptation refers to reducing either vulnerability or exposure to climate change. The UNFCCC describes it as "adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change." See https://unfccc.int/topics/adaptation-and-resilience/the-big-picture/what-do-adaptation-to-climate-change-and-climate-resilience-mean

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Adapting agriculture for today's climate challenges

Description

There has been wide consideration of the important role agriculture has in mitigating climate change. By reducing emissions, maintaining and sequestering additional carbon and moving towards net zero, farmers will become ever more important in the quest to prevent dangerous levels of climate change.

But what about the impacts of climate change we're already committed to, both now and in the future? Adapting to climate change isn't something to be left for another day, making the agriculture sector resilient to the impacts of climate change is an important action for now.

NFU climate change advisor Dr Ceris Jones and Met Office climate scientist Dr Pete Falloon, who specialises in the impacts of climate change on agriculture, explain why adaptation is so important across the whole industry.

Agriculture has had its fair share of scrutiny when it comes to climate change, with most eyes on how it has an important role to play in reducing emissions, absorbing carbon dioxide and ultimately helping prevent the very worst levels of climate change. But climate change is already happening and impacting on our industry.

What changes to our climate are we already seeing?

The earth's atmosphere has already warmed by around 1.1°C and although global temperature increases such as 1.5°C or even 2°C may sound small, it's not just the relatively small global temperature rises that impact us on the earth's surface.

Generally, in the UK, we're seeing warmer, wetter winters and hotter, drier summers and this theme is likely to continue in a warming planet. With a warmer climate there are increased levels of evaporation as a warmer atmosphere can hold more moisture. This can lead to drier conditions and droughts becoming more impactful, for example on crops and pasture growth. It also means we're seeing fewer frosts which reduces the number of chill hours needed for production of some crops.

Aerial view of flooding on Henry Ward's farm in Lincolnshire, December 2019. Credit: Dominic Swire / NFU

Along with slower changes in average climatic conditions, we're already seeing more extremes which can be directly attributed to climate change. As the warmer atmosphere can hold more moisture – approximately 7% more per 1°C of warming – when it rains we can see higher totals, bringing an increase in flood risk. We're also likely to see an increase in intense summer rainfall which could cause damage to crops at an important time of year in the cropping cycle.

These changes will be slightly different depending on where you are in the UK. The Met Office worked with the BBC to create a free interactive postcode checker so you can see the potential impacts of future climate change in your area.

With agriculture on the frontline of many climate impacts, it's important that the UK's farmers are resilient and able to operate viable businesses and produce food in a more challenging climate. We have already seen more and more severe flooding events happening across the country, alongside periods of drought and high temperatures and these are only going to get more frequent. As people who run businesses which are dependent on the weather, it's important farmers do all they can to adapt to these impacts.

As a sign of its importance, agriculture is referenced frequently in the Government's recent Climate Change Risk Assessment, with a number of risks and opportunities recognised for the industry.

How can farmers adapt to climate change?

Adapting to climate change will require investment to be supported but not everything needs to be a costly infrastructure project, it can start from something as small as moving a gate to a drier part of a field to provide resilient year-round access or making sure your drainage in hardstanding areas is free

from blockages and able to cope with heavy downpours to prevent flood damage. Are there simple solutions that would work for you to provide livestock adequate shelter from severe weather and intense summer heat?

Equally there are some more long-term strategic decisions that the industry, research, government and the supply chain need to be thinking about, whether that's developing innovative approaches to managing and monitoring new pests and diseases, breeding crops and livestock that are more resilient to heat stress, ensuring that farmers get a fair share of water or better sharing climate risk across the supply chain. We need to work together to ensure that the solutions are available and viable for those producing the food that feeds the UK.

What are the benefits of farm adaptation?

What is great about many of the actions we can take to adapt to climate change is that they can also help mitigate against global warming and benefit biodiversity and society. One of the clearest examples of this is building up soil organic matter where possible. Not only is this good for carbon sequestration, but it can also lead to better water-holding capacity, which will help crops in drier summer conditions, and benefit soil biodiversity.

Dry, Parched ground with deep cracks in a ripe wheat field at sunset. Credit: NFU

There's no one solution to making sure that UK agriculture is ready for the impacts of climate change, but the cumulative effect of lots of different measures on-farm and beyond can add up to make a real difference.

How can I find out more?

We’ll be talking more about adapting to climate change in a Twitter Spaces live conversation on 1 March at 16:00. Follow @MetOffice and @NFUtweets on Twitter to tune in and learn more.

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Triple storms and double reds – looking back on a historic week

Description

Simon Brown is Director of Services with the Met Office. He leads a directorate which supplies Government, and a host of organisations with the weather forecast. Here, he shares his thoughts on one of the Met Office's most historic weeks.

It has been one of the most remarkable and busiest weeks ever for the Met Office in its 168-year history. Three storms named in the one week, two Red Weather Warnings and some of the highest wind speeds we've seen recorded in over 30 years.

Our forecasts and warnings, briefings to government and a host of organisations and our communications to the media and the public, helped protect people across the UK from the worst impacts of storms Dudley, Eunice and Franklin.

As Services Director at the Met Office, my role brings much social discussion and humour from my friends about the weather, but I can tell them confidently that Met Office technology is second to none.

Government, councils, transport operators, the NHS, businesses, and citizens were able to take early and pre-emptive action to stay safe. Our warnings help to inform decisions to be made to close schools, suspend flights, trains and ferries, close bridges, postpone appointments and deploy flood defences.

A collection of stats through the week for the Met Office

In recent years, huge investment in our supercomputing capability has enabled us to increase the detail of our Global and UK weather models. We also have improved data assimilation and use more sophisticated satellite and observational data. Use of ensembles, (where we forecast the weather based on a series of probabilistic forecasts) or multiple runs, of forecasts using these models, has given us much greater confidence in outcomes. This in turn allows earlier identification of risks such as those associated with severe storms, which can be refined closer to the event. This, resulting from the long-standing and tireless efforts from our numerical weather prediction (NWP) modelling team of scientists and technologists, has led us to the point where we can now identify storms and issue warnings days before they are seen to be visibly forming on satellite imagery.

As storms Dudley, Eunice and latterly Franklin blew in and the country braced and braced again as to their effects; several days previously, behind the scenes in the Met Office a team of highly skilled professionals had already swung into action.

Our expert operational meteorologists predicted the storms over five days before they happened and, even ahead of the naming of Dudley and Eunice, email briefings to government through the Cabinet Office were being shared.

As well as keeping the public up to date with the weather, the Met Office also supplies information to a host of organisations including the UK Government, as well as the Governments in Scotland, Wales and Northern Ireland, the Environment Agency, Scottish Environment Protection Agency, Natural Resources Wales, RNLI, local authorities and emergency services across the country, energy providers, road and rail operators, the Civil Aviation Authority, National Air Traffic Service, and airports including Heathrow. The information we supply, allows them to make decisions relating to travel and public safety as well as deciding on the possible flooding impact – it includes detailed technical data and analysis specifically for their needs.

So, when were the storms first forecast?

One of the key headlines in the UK three-month outlook for winter (Dec, Jan & Feb), issued in late November 2021 to planners in government and business, stated that there was a “moderate increase in the potential for impacts from strong winds later in the period”. This was based on output from a number of long-range simulations of the atmosphere coupled with expert meteorologists’ knowledge and experience of several known large-scale global drivers of the weather.

The signs and patterns had therefore long been indicating that February could see an increased chance of wet and windy weather.

Ten days out, our meteorologists had indeed picked up on such a signal for increased storminess across the UK from the middle week of February. When looking this far ahead, we forecast the weather based on a series of probabilistic forecasts – known as ensembles. This is where our meteorologists were able to identify the signal that the following week could be particularly stormy across the north.

Come Monday morning the simulations had moved to clearly identify continued very windy weather for the rest of the week. Confidence had increased enough for our team, in consultation with the Civil Contingencies Advisors team – who lead our briefing with the Cabinet Office, devolved governments

and local authorities – and our media team, to name not one but two storms for the coming week – Dudley and Eunice. This was the first time that two storms had been named at once since the naming scheme began in 2015. Not only that, Eunice was named four days before the storm was even expected to develop, let alone bring its impacts. The severity of the forecast impacts were such that two rare red National Severe Weather Warnings were issued for Storm Eunice, behind Eunice on Friday 18 came Franklin, named on the Sunday for the impacts expected over Northern Ireland during the early hours of Monday morning. This was the first time that three storms had been named within the same week.

Thankfully, whilst it is still windy, Franklin has now dissipated and, as we all contemplate repairing any damage we may have suffered – what's predicted in the coming days? Well, the strong jet stream is continuing to drive weather systems across the North Atlantic, bringing more wet and windy weather for most this week. We have therefore issued a Yellow Warning for much of Scotland for wind and snow .

I am proud to recognise the fantastic work that's gone on during this extraordinary weather week at the Met Office. While it is truly tragic to hear that lives have been lost, along with flooding and widespread damage to buildings, the tireless work of our meteorologists and all our staff has allowed early action to be taken, helping to protect many people from the impact of the weather.

Since the Met Office was created in 1854 my predecessors have built a strong legacy and we keep evolving. Our ability to produce better forecasts is never more crucial with climate change and an increasingly fast, dynamic and personalised society, I'm proud to lead our Services Directorate and help ensure citizens, industry, and government have increasingly accurate forecasts and information to make better decisions to stay safe and thrive.

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Preparing the scientific response to increasing climate challenges

Description

The recent run of storms Dudley, Eunice and Franklin have brought into sharp focus the huge value of being able to forecast, and prepare for, extreme weather.

Whilst the jury is still out on the role of climate change in these storms, we do know that climate change will bring more heat waves and more flooding, and not just in the UK but across the world, write Professor Stephen Belcher (Met Office Chief Scientist) and Professor Jason Lowe OBE (Met Office Principal Fellow Applied & Climate Science).

African farmers now benefit from long-range weather forecasts and weather warnings for rainfall to manage their crops. Picture: Shutterstock.

Today the IPCC publishes the second part of its 6th Assessment of climate change from the Working Group II on Impacts, Adaptation and Vulnerability to climate change. The report shows that the impacts of climate change are more severe than previously thought, and that the risks are increasing. There are stark warnings that flooding, heat waves affecting health and damaging wildfires are becoming more severe, and that the effects are being felt sooner than previously thought. In many parts of the world, we are not even resilient to present day climate.

Whilst the new Working Group II report makes it clear that every nation is vulnerable to climate

change, some nations are much more vulnerable than others. So, the need to adapt to future climate is a strong imperative, in addition to the urgent need to decarbonise and ensure we minimise the damage by limiting global warming to 1.5 degrees.

How can science and innovation support this transformational change?

Firstly, we need to know just how extreme the weather events will be, and their character at the local scales on which impacts happen. This requires a new type of modelling that combines our current physics-based climate models of the weather systems with the power of AI to create data that reveals the evolving character of future weather extremes at the granular level where impacts occur. Early steps on this path show great promise: the UK's climate projections, UKCP18, have new modelling that provides more confidence in changes to short-lived intense rainfall enabling more effective adaptations. For example, recent work by Newcastle University, the Met Office, JBA consulting and other industry partners has used the most spatially detailed climate information from UKCP18 to quantify upgrades required to city drainage systems to prepare for future flooding.

Secondly, we need to get better at building the multi-disciplinary teams required to move from the hazards presented by extreme weather to the impacts of these weather events, and then to identify, plan and implement good adaptation. This means giving a clear voice to the local people affected by the extreme weather, alongside climate specialists, engineers, architects, city planners, and local and national government. Recently, the Met Office and several city councils have come together to develop climate change city packs, which identify the risks of climate change. This has informed Bristol City Council's Heat Resilience Framework, which combines local knowledge of thresholds associated with high temperature impacts on health and wellbeing with climate projections to make them more meaningful to future planning.

Thirdly, adaptation comes in many forms. In some situations, early warning might be the right approach. For example, African farmers now benefit from long-range weather forecasts and weather warnings for rainfall to manage their crops. In other situations, such as large-scale infrastructure like the Thames Barrier, when large investment is required, a risk assessment that includes both the most likely future outcome and reasonable worst-case scenarios, in this case for sea level rise, might be a better approach. Nature-based solutions can also offer appropriate routes to adaptation.

Recently, Met Office climate data has been used by the National Trust to map their exposure to the changing climate and to improve their resilience. Their specialists are now acting, for example by restoring and protecting peatlands, which are vital stores of carbon as well as important habitats for a range of plant and animal species.

Last November the COP26 conference in Glasgow rightly shone a light on the need move to net-zero greenhouse emissions to stabilise global warming below 1.5 degrees. But our climate has changed and will continue to change until we achieve net zero emissions. Whilst there are good examples of adaptation, the IPCC report shows that we need to move faster and on a larger scale. We need science and innovation to bring about a transformation to societies, making them resilient to climate change.

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